Coastal Hazards Resilience Network (CHRN) 2019 Annual Meeting
Wednesday June 5th, 2019 – 9:00 a.m. - 4:00 p.m.
University of Washington Tacoma Campus

Theme: Coastal Flooding & Erosion

Audience: Meeting open to CHRN members and stakeholders, agencies, local governments, academics, Tribes, and non-profits affected by and involved in coastal hazards planning.

Goals:

- To promote information exchange on the current state of knowledge about erosion and coastal flooding, and share resources needs for and lessons learned from projects in Washington State and other coastal states.
- To create a space for practitioners and stakeholders to connect and develop relationships, and ultimately partnerships.
- To create an opportunity for more coordination and collaboration between actors when addressing coastal hazards and improving coastal resilience.

Agenda

8:30-9:00  Check-in, Coffee, and Networking Board
           *Purpose: To give everyone the opportunity to mention projects or issues they are working on and to connect and potentially partner with other audience members.

9:00-9:15  Welcome
           Felicia Olmeta-Schult, Washington Sea Grant Marine Policy Fellow
           Shoreline & Coastal Management, Washington Department of Ecology

9:15-10:45 Coastal Flooding & Erosion State of the Science
           *Four 15-min talks with 20 min for discussion with the presenters.
           *Time for 2 short Q&A after each talk.
           *Purpose: To share with the audience the current state of knowledge around erosion and coastal flooding in Washington State. This will be done by presenting both scientific and local community perspectives on these hazards, and what we could expect in the future.

- Coastal Erosion Assessment for Grays Harbor County Hazard Mitigation
  George Kaminsky, Coastal Monitoring & Analysis, Department of Ecology
- Where we are and what’s next?
  Jerry Franklin, Floodplain Management, Department of Ecology
  Ted Perkins, FEMA Region 10
- Washington Coastal Resilience Project Update: Extreme Coastal Water Level Assessment to support SLR Planning
  Ian Miller, Washington Sea Grant
- What’s making future sea level so hard to predict accurately?
  Robert Bindschlauder, NASA Emeritus Scientist

10:45-11:00  Break
11:00-12:30   How are Coastal Communities in Washington Dealing with these Issues?
*Four 15-min talks with 20 min for questions at the end.
*Time for 2 short Q&A after each talk.

**Purpose:** To give an opportunity to coastal communities to explain how they addressed or will address erosion and coastal flooding issues, and to share lessons learned from these projects.

- Updates from the shoreline: Addressing sea level rise impacts in King County
  Lara Whitely Binder, King County

- Sea Level Rise Hazard Mapping, Decision Tools, & Data
  Andrea MacLennan, Coastal Geologic Services

- Nature-Based Dynamic Revetment for Shoreline Stabilization at North Cove
  George Kaminsky, Coastal Monitoring & Analysis, Department of Ecology

- Low and Wet: A Multiple Benefits, Multiple Entity Coastal Flooding Adaptation Case Study from the Dungeness River Delta
  Ian Miller, Washington Sea Grant

12:30-1:15   Lunch (provided)

1:15-2:30   How are other States Dealing with these Problems?
*Three 15-min talks and 20 min for questions at the end.
*Time for 2 short Q&A after each talk.

**Purpose:** To learn about regulations, tools, resources and other approaches used by other coastal states to address erosion and coastal flooding.

- Addressing coastal hazards through the NC Coastal Zone Management Program
  Braxton Davis, North Carolina Division of Coastal Management
  Department of Environmental Quality

- Addressing coastal hazards along the California coast through planning and permitting
  Mary Matella, California Coastal Commission

- Addressing coastal erosion in Hawaii
  Justine W. Nihipali, Hawaii Coastal Zone Management Program

2:30-2:45   Break

2:45-3:45   CHRN Happenings
*Three 20-min talks (including Q&A).

**Purpose:** To present work in progress on the new CHRN website, including tools such as the Coastal Adaptation Atlas. To discuss the future of the CHRN annual meeting and its conversion into an annual conference.

- The CHRN website: a Revamped Resource
  Jackson Blalock, Washington Sea Grant
• **CHRN’s Adaptation Case Studies**  
  *Katrina Radach, Washington Sea Grant Marine Policy Fellow*  
  *The Nature Conservancy*

• **Coastal Hazards Conference 2020**  
  *Bobbak Talebi, Shoreline & Coastal Management, Department of Ecology*

3:45-4:00  **Closing**  
*Felicia Olmeta-Schult, Washington Sea Grant Marine Policy Fellow*  
*Shoreline & Coastal Management, Department of Ecology*

4:30-6:00  **Be Happy and Connect with your Colleagues**  
@ [Harmon Brewing Company](1938 Pacific Ave, Tacoma 98402).

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See next page for additional details (directions, parking, Wi-Fi access, etc.)
Meeting Details

The CHRN 2019 Annual Meeting will take place at University of Washington Tacoma Campus. Set in the historic Union Station District, UW Tacoma owes its charm to century-old, brick buildings that were built to last by businesses that depended on the railroad in the late 1880s and early 1900s. The 46-acre campus footprint is located on a hillside overlooking the Port of Tacoma and Mount Rainier, on the southern edge of downtown Tacoma, next to museums and the beautifully reconstructed Union Station.

Note: Non-YMCA member attendees of the event are not permitted to use the recreational facilities (locker rooms and restrooms not included), equipment, services, or programs of the University Y Student Center while in the facility.

Directions: University Y Student Center (UWY) Room 304, 1710 Market St, Tacoma, WA 98402 (Google Map).

Parking options (click here for parking map):
- There is free street parking around the UWY.
- Lot WT40 (Court 17 Garage; enter from Court C and 17th; 18 all-day parking spots available).
- Lot WT31 (SW Jefferson and 21st; bigger lot, also all-day and hourly parking).
- Another option is parking at the Tacoma Dome Garage for free and taking the Link Light Rail that runs every 10 minutes from the garage to campus (about a 5 minute ride).

Lunch and coffee/tea will be provided. Lunch boxes labeled for people with dietary restrictions. Paper cups will be provided. To save from waste, feel free to bring your personal travel mugs.

UW guest wireless access:
1. To login to UW Wi-Fi, please ensure Wi-Fi is turned on via your device settings and select the University of Washington as the Wi-Fi network to connect to.
2. Open your internet browser and view a webpage outside the UW to bring up the authentication page.
3. You will then be automatically prompted to enter the supplied UW NetID: event0532 and Password: w5d4=m9t5=n7a6
4. Once you have successfully logged in (authenticated) you will be able to use services outside the UW for up to 12 hours without having to re-authenticate.

Slido access:
- Slido is a tool that allows you to submit your questions and express your opinion by sending your votes in via live polls.
- Each presentation will be 15 minutes long with 1-2 questions at the end (~3-5 minutes total). After the presentations, we will have 20 minutes for questions. Submit your questions or vote for them (“thumb up”) using Slido anytime during the session. We will start the 20 minutes with the questions with the most “thumbs up.”

To join:
1. Simply take out your smartphone or laptop and open your browser.
2. Go to Slido.com and enter the event code #CHRN2019.
3. You can now ask questions and up-vote the best ones.
4. If you have a question for a speaker in particular, make sure to mention their name.
Coastal Erosion Assessment for Grays Harbor County Hazard Mitigation

George Kaminsky, Diana McCandless, and Alex Rosen
Motivation

1. Despite the long history of coastal erosion impacts in Grays Harbor County, this hazard was never included in the County’s Hazard Mitigation Plan.

2. Including coastal erosion in the County Plan provides a basis for local jurisdictions to develop additional information for their local plan.

3. The County and incorporated cities are eligible for project design funds to address the hazard.

4. The coastal erosion hazard profile for this relatively data rich area provides a model for content to be developed for other counties.

5. Ultimately, improved county hazard profiles improves the State Hazard Mitigation Plan.
Washington State
Enhanced Hazard Mitigation Plan

https://www.mil.wa.gov/other-links/enhanced-hazard-mitigation-plan

Effective 2018-2023
Approved 10/1/2018
Prepared by the Washington Emergency Management Division
Grays Harbor County
2018 Multi-Jurisdiction
Hazard Mitigation Plan Update
Volume 1: Planning-Area-Wide Elements

FINAL
July 2018
Grays Harbor County Coastal Erosion Profile

1. General Background – What is coastal erosion, and how, when, and where does it occur?
2. Coastal erosion planning – consider a decade back and forward
3. Map and quantify EHAs – impacted structures, parcels, shoreline extent, acres
4. Document and describe previous occurrences of erosion
   a. For GHC, this includes coastal construction and mitigation history
5. Describe recent erosion events and conditions - causes, effects, and responses
6. Vulnerability Assessment – Impact on:
   a. Life, Health and Safety
   b. Property
   c. Critical Facilities and Infrastructure
   d. Economy
   e. Environment
7. Future Development Trends – needs and challenges
### Summary Inventory of Grays Harbor Erosion Hazard Areas

<table>
<thead>
<tr>
<th>Jurisdiction &amp; Name of Area</th>
<th>Number of Structures</th>
<th>Number of Parcels</th>
<th>Length of Shoreline (km)</th>
<th>Number of Acres</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>City of Ocean Shores</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Jetty area</td>
<td>13</td>
<td>31</td>
<td>2.53</td>
<td>1.57</td>
<td>16.9</td>
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<tr>
<td>Oyhut Wildlife Recreation Area</td>
<td>20</td>
<td>30</td>
<td>3.28</td>
<td>2.04</td>
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<td><strong>City of Westport</strong></td>
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<tr>
<td>Westport</td>
<td>9</td>
<td>49</td>
<td>4.00</td>
<td>2.49</td>
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<td>49</td>
<td>4.00</td>
<td>2.49</td>
<td>25.6</td>
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<td><strong>Grays Harbor County</strong></td>
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<tr>
<td>Copalis River &amp; Connor Creek</td>
<td>3</td>
<td>24</td>
<td>3.73</td>
<td>2.32</td>
<td>141.7</td>
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<td>Cohassett Beach</td>
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<td>0.93</td>
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<td>Whitcomb Flats</td>
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<td>1.55</td>
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<td>25</td>
<td>12.10</td>
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<td>135</td>
<td>21.91</td>
<td>13.62</td>
<td>547.4</td>
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</table>
Westport Erosion Hazard Area projected from 2018 to 2028

with 2002-2016 change rates in ft/yr

Legend
- > 2 meters (6.5 ft) per year
- 1 - 2 meters per year
- < 1 meter (3.3 ft) per year

Map Projection: Washington State Plane South, NAD-83, meters
Washington State Department of Ecology
Coastal Monitoring & Analysis Program
Photo: 2016 BING
Profile “Worm”

Historical scarp retreat rate = **2.2 m/yr**

Summer 2015 to Winter 2016 = **15 m** of dune erosion

March 2016

![Graph showing cross-shore distance vs. elevation with data points from Summer 1997 to Fall 2015.](image_url)
## History of Beach and Nearshore Nourishment in Grays Harbor County

<table>
<thead>
<tr>
<th>Year</th>
<th>Nearshore Sites</th>
<th>Beach Sites</th>
<th>Description of Beach Nourishment</th>
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<tbody>
<tr>
<td></td>
<td>South Beach (cy)</td>
<td>Half Moon Bay (cy)</td>
<td>Breach Fill (cy)</td>
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<tr>
<td>1992</td>
<td>200,000</td>
<td></td>
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<tr>
<td>1993</td>
<td>373,000</td>
<td></td>
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<tr>
<td>1994</td>
<td>265,000</td>
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<td>600,000</td>
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<td>1995</td>
<td></td>
<td>300,295</td>
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<td>1996</td>
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<td>1999</td>
<td>76,187</td>
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<td>2003</td>
<td>125,388</td>
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<td>262,176</td>
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<td>217,909</td>
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<td>2008</td>
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<td>171,353</td>
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<td>2009</td>
<td>214,502</td>
<td>144,975</td>
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<td>2010</td>
<td>118,182</td>
<td>91,720</td>
<td>30,000</td>
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<td>2011</td>
<td>298,251</td>
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<td>2012</td>
<td>142,313</td>
<td>111,205</td>
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<td>2013</td>
<td>477,637</td>
<td>86,147</td>
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<td>2014</td>
<td>498,440</td>
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<td>2015</td>
<td>506,330</td>
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<td>3,350</td>
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<tr>
<td>2016</td>
<td>544,980</td>
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<tr>
<td>2017</td>
<td>499,001</td>
<td>101,019</td>
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<tr>
<td>Sum</td>
<td>4,749,685</td>
<td>3,829,572</td>
<td>875,032</td>
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<tr>
<td></td>
<td>Total Nearshore</td>
<td>Total Beach</td>
<td>Total Beach</td>
</tr>
<tr>
<td></td>
<td>8,579,257</td>
<td>1,496,340</td>
<td>83,700</td>
</tr>
</tbody>
</table>
Westport Summary

- The South Beach shoreline along Westport and Cohassett Beach are experiencing a sediment deficit that is not likely to be augmented by natural processes.
- Loss of dune and coastal erosion threatens condominiums and houses fronting Dune Crest Drive.
- Dune erosion scarp extends from the jetty to 5.1 km south along shoreline.
- Shoreline position is dependent on jetty breach fill condition.
- Average erosion of 63,100 cubic yards/year of sediment from beaches and dunes.
- Beach and dune nourishment in Westport is essential to avoid catastrophic losses to upland development and infrastructure.
- The maintenance of the Half Moon Bay shoreline is relatively intense, consisting of routine nearshore and beach nourishment, and relatively routine repair of the Point Chehalis revetment.
Profile “X1 South”

Summer 1997 to Winter 1998 =
~0.7 m beach lowering

Summer 2015 to Winter 2016 =
~2 m beach lowering
Oyhut Erosion Hazard Area projected from 2018 to 2028

with 2006-2016 change rates in ft/yr

Legend

- > 2 meters (6.5 ft) per year
- 1 - 2 meters per year
- < 1 meter (3.3 ft) per year

Map Projection: Washington State Plane South, NAD-83, meters
Washington State Department of Ecology
Coastal Monitoring & Analysis Program
Photo: 2015 NAIP
Oyhut Bay and Quinault Marina Summary

- Long term erosion threatens loss of RV and marina facilities and boat access
- Overwash of Damon Spit and sedimentation of Marina and boat access channel
- Damon Spit becoming narrower, flatter, and migrating toward Marina
- Long term viability of Marina will require considerable engineering and maintenance dredging
- The Marina breakwater and the eastward end of the maintained North Jetty near the wastewater treatment plant provide anchor points that control the equilibrium location of the Oyhut Bay shoreline.
- More study is needed to develop a long-term prediction of the Oyhut shoreline and the relative importance of the anchor point at the Quinault Marina.
Copalis River and Connor Creek – Mouth Migration
Copalis River and Connor Creek – Mouth Migration
FEMA’s Coastal Flood Mapping Efforts

Ted Perkins, PE
Regional Engineer
FEMA Region 10
June 5, 2019
• Background of the National Flood Insurance Program
• Regional Coastal Flood Study Efforts
Purpose of the National Flood Insurance Program (NFIP)

Reduction in Annual Flood Premium*

- 25% for 1 foot elevation
- 50% for 2 feet elevation
- 62% for 3 feet elevation
- 67% for 4 feet elevation

Floor Elevation Above BFE

*Example: V-Zone building with an open foundation, $250,000 building coverage, $100,000 contents coverage. Reductions compared to lowest flood at BFE. Note: This does not include recent rate increases. (FEMA Home Builder's Guide to Coastal Construction)
Basis for Floodplain Mapping

250,000 Rivers in US – on average 2,500 rivers are seeing the 1% flood or greater every year.

3,500,000 Miles of River – on average 35,000 miles of river are seeing the 1% flood or greater every year.

42,500 Miles of Coastline are mapped – on average 425 miles of coastline are seeing the 1% flood or greater every year.
RiskMAP, the NFIP and Hazard Mitigation Planning

RiskMAP
Increasing Resilience Together

Goals
- Deliver High-Quality Risk Data

Products
- Intuitive Flood Maps
- Credible data - reliable, accurate, watershed-based
- Illustrations of Flood Depths
- Valuable Flood Risk Assessments

Processes
- Enhance delivery of Risk MAP Products
- Collaborate across all levels of government

MITIGATION PLANNING

Increase Awareness of Flood Risk
- Tools to understand how flood risk has changed
- Continuous engagement with communities
- Enable communities to communicate flood risk to constituents

Promote Community Mitigation Actions
- Support that allows communities to identify and risks and promote:
  - Community resiliency
  - Sustainability
  - Reduced need for federal disaster assistance

Reduce Risk to Lives and Property
Washington Risk MAP Website

https://waecy.maps.arcgis.com/apps/MapSeries/index.html?appid=8451cb0db0c4461182e592eb5a43400a
## Guidelines for Coastal Flood Hazard Mapping and Analysis for Pacific Coast of the United States

January 2005

<table>
<thead>
<tr>
<th></th>
<th><strong>Old Approach</strong></th>
<th><strong>New Approach</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Wind data</strong></td>
<td>Short Periods of Observations</td>
<td>Regional Hindcast Models</td>
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<tr>
<td><strong>Water Level Model</strong></td>
<td>Seattle Tide Gage</td>
<td>ADCIRC Model Puget Sound</td>
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<tr>
<td><strong>Wave Model</strong></td>
<td>1-Dimensional</td>
<td>2-Dimensional (SWAN)</td>
</tr>
<tr>
<td><strong>Topography</strong></td>
<td>USGS Contour Maps</td>
<td>2010-15 LiDAR data</td>
</tr>
<tr>
<td><strong>Study Scope</strong></td>
<td>Detail Few Specific Areas</td>
<td>Entire Populated US Coastline</td>
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</tbody>
</table>
Coastal Analysis Overview

Step 1: Offshore Water Level and Wave Modeling

Step 2: Nearshore Wave Setup, Runup & Overtopping

Step 3: Floodplain Mapping
Step 1: Salish Sea & Puget Sound Water Level Modeling

Baseline

Meteorological Forcing

Wind

Physical Setting

Bathymetry

Still Water Elevations
Step 1: Salish Sea & Puget Sound Water Level Modeling (ADCIRC)

- ADvanced CIRCulation Model (ADCIRC)
- Model Inputs:
  - Bathymetry
  - Wind forcing
  - Pressure
  - Tidal forcing
- Model Outputs:
  - Water elevation for 150 peak water level events
Example Calibrated ADCIRC Water Level Seattle

Example Calibrated ADCIRC Water Level Friday Harbor
**Step 1 - Wave Modeling**

- SWAN model grid
- Variable grid resolution for nearshore/offshore regions
- 50-year hindcast wind fields
- 150 modeled storm events
Step 2: Wave Setup, Runup & Overtopping (Transect Analysis)

Transect Analysis

Water Level & Wave Data

Cross-Shore Transects

Total Water Level

1. Water Level (Surge)
2. Waves
3. Setup, Runup and/or Overtopping
Step 2: Wave Setup and Runup (Transect Analysis)

- Wave Height
- Wave Period
- SWEL
- Profile Slope

- Wave Setup
- Wave Runup

Diagram shows waves, setup, runup, and total water level.
**Step 3: Floodplain Mapping**

![Diagram showing floodplain mapping with VE Zone, Coastal AE Zone, and AE Zone. VE Zone is marked by wave height ≥ 3.0 ft, Coastal AE Zone by wave height between 3.0 and 1.5 ft, and AE Zone by wave height < 1.5 ft. Notations include wave crest elevation profile, 1% SWEL level, BFE depth, stillwater flood depth, and ground profile.]
• River/Lake A Zone
• Transect
• AE Zone
• Zone Break
• VE Zone
QUESTIONS???

Ted Perkins, PE
Regional Engineer
FEMA Region X
Dwight.perkins@fema.dhs.gov
425-487-4684
WCRP Update: Extreme Coastal Water Level Assessment

Ian Miller, PhD
Coastal Hazards Specialist
Washington Sea Grant
immiller@uw.edu

With

Guillaume Mauger
Harriet Morgan
Eric Grossman
Nathan Van Arendonck
Zhaoqing Yang
WCRP Update: Extreme Coastal Water Level Assessment

Updated sea level projections published last summer

Available at http://www.wacoastalnetwork.com/ along with supplementary data and materials
How frequent are “extreme” events at my location? How high can they get? How high WILL they get?
Incorporating extremes into SLR planning: A case study courtesy of the JSKT

Kailin Property, Blyn WA
Here is some coastal infrastructure we want to try to make good decisions about. Will it possibly be at risk during an extreme event in the future?
Planning Scenario: Highest Water Level in 2014
Planning Scenario: RCP 8.5, 1% chance of exceedance (high magnitude, low probability)
Elevation Profile for Kailin Property

Profile based on 2012 FEMA Lidar using ArcGIS 3D Analyst. Note: Horizontal exaggerated compared to the vertical to display topography. Note: These tidal elevations do not include the increased height of storm tides.
Elevation Profile for Kailin Property

Profile based on 2012 FEMA Lidar using ArcGIS 3D Analyst. Note: Horizontal exaggerated compared to the vertical to display topography.

Note: These tidal elevations do not include the increased height of storm tides.
Planning Scenario: Highest Water Level in 2014

Profile based on 2012 FEMA Lidar using ArcGIS 3D Analyst. Note: Horizontal exaggerated compared to the vertical to display topography.

Note: These tidal elevations do not include the increased height of storm tides.

Lets go back to here…this is the step we are trying to inform with our current work.
First Key Element: “Still” vs. “Total” Water Level

The maximum elevation that water is pushed on the shoreline, or "Total Water Level"
Second Key Element: A Return Frequency Framework (where possible)
Third Element: Tie everything to current MHHW

31 May 18, ~8:00 pm
SWL = 0.0 ft MHHW
credit: Melissa Poe

17 Dec 12, ~8:30 am
SWL = 3.1 ft MHHW
credit: West Seattle Blog

29 Nov 14, ~10:30 am
SWL = 1.8 ft MHHW
credit: Melissa Poe
The key result: **SWL**

<table>
<thead>
<tr>
<th>Sea Level Scenario (feet)</th>
<th>Return Frequency:</th>
<th>Puget Sound/Strait of Juan de Fuca</th>
<th>Coast</th>
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<tbody>
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<td></td>
<td>2-yr</td>
<td>5-yr</td>
<td>20-yr</td>
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<td>2.2</td>
<td>2.6</td>
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<td>0.5</td>
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</table>
A Puget Sound “Extreme Event”

3.1 ft relative to MHHW

Photo from Cliff Mass Weather Blog, courtesy of West Seattle Blog

Seattle, 17 December 2012
Use it to assess the change in frequency of an existing event

<table>
<thead>
<tr>
<th>Sea-level scenario</th>
<th>Still Water (i.e. tides + surge) Return Frequency in feet relative to MHHW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-yr</td>
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<tr>
<td>0</td>
<td>0.8</td>
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<td>1.3</td>
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<td>1.8</td>
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</tbody>
</table>

Every Day at High Tide
Key Result: TWL on the coast

<table>
<thead>
<tr>
<th>Sea Level Scenario (feet)</th>
<th>Toke Point/South Coast</th>
<th>Makah Bay/North Coast</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-yr</td>
<td>5-yr</td>
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<tr>
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<td>20.5</td>
</tr>
<tr>
<td>10.0</td>
<td>20.9</td>
<td>21.5</td>
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</tbody>
</table>
What if I want a TWL return frequency information on Puget Sound?

Answer 1: Maybe you don’t really need it

Answer 2: Use something like a BFE

Answer 3: Maybe you can use an event of record for your location?

Answer 4: New wave modelling provides some sense for the real extremes…but its not perfect
Thank you!
What's making future sea level so hard to predict accurately?

Robert Bindschadler (NASA – retired) and

Ted Scambos¹, Twila Moon², Waleed Abdalati¹, Jill Gambill³

¹ESOC, ²NSIDC, both at CIRES, University of Colorado Boulder; ³Marine Extension and Georgia Sea Grant, University of Georgia
Multiple Global & Regional Effects

- **Glaciological**
  - Ice Mass Loss
- **Geodetic**
  - Gravitational
  - Tectonic
  - Subsidence
- **Oceanic**
  - Temperature
  - Currents
- **Meteorological**
  - Wind-driven waves
Global Sea Level Trend, 1993-2018

Rate = 3.2 ± 0.4 mm/year;
Increasing by ~0.1 mm/year, each year

Leuliette, 2018; NOAA Laboratory for Satellite Altimetry
Observed and Projected Change in Global Mean Sea Level

IPCC AR5 projected 20 to 90 cm, depending on GHG

– but not the full story.
Including potential aspects of **rapid ice sheet** & **glacier decline** broadens projected range.
Forecasts for ocean heat and glacier loss

Thermal expansion

Glaciers & Ice caps

Relatively well-constrained

Narrow potential range

Kopp et al., *Earth’s Future*, 2014
Large potential future SLR from land ice loss

Greenland

Wide range of possible contributions

If increased snowfall dominates

Antarctica

Wide range of possible contributions

If ice sheet runaway decline occurs

...with a very strong asymmetry

Kopp et al., Earth’s Future, 2014
Oceanic Perimeter is Key

Ice sheets HATE water!
Complex dynamics at the floating edge of an ice sheet

Marine Ice Cliff Instability
(Example: Helheim Glacier, Greenland)

Marine Ice Sheet Instability
(Example: Thwaites Glacier, Antarctica)
Ice Shelves Buttress Ice Sheets

Require >10,000 years to form
Disintegrate in weeks

Source: W. Rack

180 miles: Seattle to Portland
Sea level rise will not be evenly distributed

Sea level rise due to ice loss from Greenland Ice Sheet under RCP8.5, mm/year

Sea level rise due to ice loss from West Antarctic Ice Sheet under RCP8.5, mm/year

Horton et al., Ann Rev Env Resour, 2018
Sea level rise will not be evenly distributed

Dynamic sea level change under RCP8.5, mm/year

Horton et al., *Ann Rev Env Resour*, 2018
Summary

• SLR projections are very complex and highly dependent on future GHG concentrations

• Major additional uncertainty in land-ice contributions to SLR result from complex dynamics at the oceanic edges of ice sheets
  – Strongly asymmetric (slightly better or much worse are equally probable)

• Progress is being made
  – field studies are ongoing, but challenging

• Source of land-ice contributions matters--A LOT!
Thank you!

Questions?
Updates from the shoreline: Addressing sea level rise impacts in King County

LARA WHITELY BINDER
CLIMATE PREPAREDNESS SPECIALIST
KING COUNTY

CHRN Annual Meeting
June 5, 2019
Random Actions of Adaptation (2007-present)

- **Remapped** coastal (and riverine) floodplains.
- **Raised base elevation** for new construction to three feet above the 100-yr flood elevation.
- **Consider** sea level rise in public infrastructure projects.
- **Consider** sea level rise in shoreline restoration projects.
- **Notify** developers about sea level rise.
- **Encourage** project developers to consider sea level rise.
- **Assessed** options for coastal roads on Vashon Island.
- Multiple **impact assessments** on wastewater conveyance infrastructure.
- **Sea level rise mapping (2 and 5 feet)**
- **Impact assessments for King County-owned assets (ongoing)**
- **Developing a strategy for sea level rise (ongoing)** – includes proposed code changes
"Picking the Number(s)" for King County

Projected Sea Level Rise (Seattle)

Feet Relative to 1991-2009 average

King County has three different authorities that apply to the marine shoreline (regulatory levers)

- King County is the local land-use authority in unincorporated areas (Comp Plan, SMP, permitting).
- King County has public health authority for on-site sewage systems and drinking water supplies for the entire county (Health Code, permitting).
- King County implements certain floodplain management and flood risk reduction authorities for the entire county via agreement with the King County Flood Control District (Flood Hazard Management Plan).
Addressing Changes in Coastal Flood Risk
Key Proposal: Create a new “Sea Level Rise Buffer Zone” and set requirements within this new zone

- Higher risk area currently not protected
- With buffer, could be thought of as an AE zone for various SLR scenarios

100 yr floodplain

3ft above BFE (existing regs)

Sea level rise buffer zone

Puget Sound

= existing house

= rebuilt house based on regs
Other proposed changes related to coastal flood risk

Strengthen requirements for coastal 100-year floodplain

**Groundwater wells:**

- No new wells in the coastal floodplain
- All new wells in the SLR buffer zone need to have well casing that extends to +3 feet BFE
- Substantial improvements in floodplain or SLR buffer = well must be moved or retrofitted to +3 feet BFE standard

Similar provisions for onsite septic (in Public Health code)
Addressing Erosion and Bulkheads
Addressing Erosion and Bulkheads (Vashon/Maury Isl.)

**Trends?**
- Difficult to see trends in erosion; event-driven
- Getting more questions about SLR
- Seeing more retaining walls popping up

**Encouraging erosion is a priority**
- Focusing on 4-5 drift cells but still opportunistic; timing will sellers in target areas with available $$
- SLR “relatively easy to incorporate” in VMI restoration – pulling infrastructure out

**Changing demographics:**
- Longtime, aging owners (not all wealthy) with bulkheads reaching a certain age.
- More Air B&Bs/2nd homes (anecdotally)
Proposed Comp Plan Changes: Erosion & Bulkheads (in review)

Increased setback requirement for bluffs that extend into the coastal high hazard area or the SLR buffer:

- Establish 75 feet as the standard setback on top of steep slopes for new construction (was 50 feet).
- Allow for 50-foot setback if geotechnical report demonstrates 50 years of erosion potential.
- Require geotechnical reports to account for increased erosion and landslide rates due to sea level rise.

Notable: The one provision where we have to define an amount of SLR and a rate
Proposed Comp Plan Changes: Erosion & Bulkheads (in review)

**Strengthen bulkhead requirements for developed parcels**

- Increase toe of bulkhead elevation requirement to three feet above the Mean Higher High Water elevation level.
- If not feasible, require structure to be elevated to 3 feet above the 100-year floodplain elevation OR moved back to allow for 50 years of erosion so bulkhead is not needed.
- If the cost of elevating or moving the structure is less than the cost of the bulkhead, construction of the bulkhead “shall not be approved”
- If elevating or moving structure is not feasible, then allow toe of bulkhead to be as low as the Mean Higher High Water elevation.
**NEXT STEPS**

Comp Plan Changes
- Public meeting on Vashon specifically to discuss SLR and related proposed Comp Plan changes (July 2)
- Transmittal to Executive for review (August) and Council (Sept 30)

Other work
- Investment in USGS CoSMoS modeling (incl. bluff erosion)
- Finish SLR strategy
- 2020 Strategic Climate Action Plan
LARA WHITELY BINDER
Climate Preparedness Specialist
lwbinder@kingcounty.gov
206.263.0825

Learn more at:
www.kingcounty.gov/climate
Sea Level Rise Hazard Mapping, Decision Tools, & Data

Tools to evaluate and communicate about SLR implications

Andrea MacLennan, MS
Senior coastal geomorphologist
Coastal Geologic Services, Inc

June 5, 2019

CHRN Annual Meeting
UW Tacoma
Overview: Mapping SLR hazards, Decisions Tools, and New Data

**SLR Hazard Mapping:**
SJ County Assessment

- How vulnerable is this shore to SLR?
- What hazards are present? Where?

**Tools for Communicating & Making Decisions**

- How will my shore respond to SLR?
- What are appropriate ways to adapt?

**New Data to Inform SLR Planning & Restoration**

- Where should we focus conservation?
- Where should we focus restoration?
San Juan County Assessment

Objectives

• GIS-based assessment of coastal bluff erosion and inundation
  • Identify most vulnerable areas in county
• Friends of San Juans, funded by EPA, completed in 2013.
• SLR projections (NRC 2012):
  • 2050, 2100
  • Medium (0.5 FT, 2 FT) and High scenarios (1.6 FT, 4.7 FT)
San Juan County Assessment

Inundation

• Standard bathtub model
• Created MHHW using Vdatum
• Created contours for HOWL and each scenario and horizon
• Created polygons from lines

MHHW = Mean Higher-High Water
HOWL = Highest Observed Water Level (at Friday Harbor)
San Juan County Assessment

Coastal Bluff Recession

• Measured background recession rates from stratified sample of 50 shoreforms:
  • Shoretype
  • Wave exposure
• 1960s - 2009
• DSAS
• Digitized bluff crest from LIDAR slope data
Bluff Recession Buffers

- Different shoreforms erode at different rates
  - Feeder bluffs and transport zones/pocket beaches
  - Accretion shoreforms too variable to map
  - Exposure significant
- Bluff recession rates will accelerate with SLR
  - Rate of SLR
- Future erosion was buffered from bluff crest
  - Shoreform (2 shoretypes, 2 exposure categories)
  - Scenario (Mod, High)
  - Planning horizon (2050, 2100)
- Buffers truncated by bedrock geology
San Juan County Assessment

Results

Horizon
- 2009
- 2050Mod
- 2050High
- 2100Mod
- 2100High

Roads centerlines

[Map showing the results of the San Juan County Assessment with different color codes for each horizon.]
Objective: Make informed decisions

Tools for Communicating & Making Decisions

Shoreform Response

San Juan County Vulnerability Assessment

Appropriate Adaptation Approaches

How will my shoreline respond to sea level rise?

How vulnerable is my property? What type of hazard? When?

What are appropriate responses for my type of shoreline? What can I do about it?
Shoreform Response – Rocky Shores

Vertical shift upwards/landward shift in tidal elevation

Similar shift in intertidal habitats
Shoreform Response – Bluffs

Landward shift of entire beach profile
Bluff erosion enables local and down-drift beaches to adjust
Crest of berm will build higher and shift landward via overwash
Landward shift in habitats, dune grass, driftwood, intertidal spawners
Habitat/beach loss can occur where landward constrains limits natural migration of beach features
Static shoreline armor prevents landward migration of shoreline and habitats resulting in habitat and beach loss
Appropriate Adaptation Approaches

- Geomorphic response
- Planning horizon
- Cost of infrastructure
- Maintenance
- Opportunities
  - Habitat conservation / restoration
  - Increased resilience
Appropriate Adaptation Approaches - Relocate

- Effective for managing erosion and inundation in the long-term
- Requires adequate upland area for relocation

- Often cheaper than engineered solutions
- Most effective for septic, outbuildings, and highly vulnerable primary structures
Appropriate Adaptation Approaches - Elevate

- Only effective for managing coastal flooding, not erosion
- Driftwood can damage pilings, elevated structures etc.

Created by CGS for Friends of the San Juans
Appropriate Adaptation Approaches - Fortify

Shore armor has limitations:

- Only effective for managing erosion, not flooding
- Will not curb all bluff erosion
- Will lead to beach habitat loss
Appropriate Adaptation Approaches - Nourish

- Nourish entire beach profile
- Build a storm berm, to absorb wave energy
- Compensate (short-term) for lost sediment supply or habitat loss
Plan for accelerated erosion rates

- **Long-term bluff recession rates will increase**
  - Increase precipitation
  - More frequent “change events”
  - Higher water levels
- **Accelerated erosion tied to rate of SLR**
  - Uncertainty in WAIS melt

Download the CGS Bluff Recession report: http://coastalgeo.com/publications/bluffrecession/
New Data for SLR Planning & Restoration

Beach Strategies Geodatabase – Phase 1
Obtain from WDFW

- **Updated Shoretype Mapping**
  - Includes historic shoretypes for all armored shores

- **Updated drift cell mapping**
  - With linear referencing routes for drift direction

- **Updated shore armor mapping**
  - Ltd additional data on: toe elevation, condition,
  - Additional armor mapping info: data age, resolution, etc
New Data for SLR Planning & Restoration

Beach Strategies Geodatabase – Phase 2 available in late 2019

- Identify priority beaches for conservation & restoration
  - Sediment Supply
  - Forage Fish Spawning
  - Embayment Support
  - Pocket Beaches
- Multi-scalar, nested geographies
- Queries describing on-the-ground conditions. No black box.
- Linked with hypothesis, justification and supporting principles
Want to learn more?

andrea “at” coastalgeo.com
Nature-Based Dynamic Revetment for Shoreline Stabilization at North Cove

George Kaminsky, Heather Weiner, Diana McCandless, Amanda Hacking

Washington State Department of Ecology
Coastal Monitoring & Analysis Program
North Cove – Shoreline change

June 1990

August 2016

Google Earth imagery
North Cove – Shoreline change predictions

Shoreline Predictions
- 2015
- 2020
- 2030
- 2040
- 2050
- 2060

Predicted Annual Change Rates (meters per year)
- -33 to -40
- -22 to -33
- -19 to -21
- -8 to -19
- -8 to +8
- +8 to 13
- +13 to 16
- +16 to 21
- +21 to 26

Washington State Department of Ecology Coastal Monitoring & Analysis Program (2016)
High-resolution bathymetry data collected in June 2018
Natural cobble berm vs. built dynamic revetment

Kalaloch Beach 1

North Cove
Existing ground

Debris berm, sand and driftwood

Native dune grass. To be planted after berm and porous dynamic cobble revetment construction is completed.

Porous dynamic cobble revetment. Porous nature of revetment will absorb wave energy, rather than deflecting energy like standard revetments.

Existing scarp face, height varies from 2' to 15'
North Cove – Dynamic revetment pre- and post-storm

Before

After

Cobble settled and upper bank exposed; ~30 ft. of scarp lost, exposing the trailer seen in the photo.

Photos courtesy of David Cottrell
Low and Wet: Coastal Flooding Adaptation Efforts at the Dungeness River Delta
Background – why here?

Existing Flood Hazard
Background – why here?

Sea Level Rise Inundation Area in 2100, DUNGENESS RIVER DELTA
Probabilistic Projections of Changes to Average Daily High Tide Inundation Due to Sea Level Rise

Legend
- Current Shoreline
- Mean Higher High Water (MHHW)
- Annual Percent Chance of Occurrence
  - More Likely to Occur
  - Less Likely to Occur
- Critical Infrastructure
  - Local Roads
  - Tide Gates

Future Coastal Flood Hazard

Updated March 2017
Background – why here?

Contemporary habitat degradation in an important habitat zone, due to armoring and septic tanks...that may get worse.
Multiple Entity Group convenes

2013: JSKT develops climate change plan. Dungeness delta pops

2015: UW PoE students complete a communications toolkit for landowners

2016: Hansi Hals convenes a working group to start to work on next steps for landowner outreach
Attendees, talking ~ 2x per year

- JSKT
- Washington Department of Ecology
- Clallam County Community Development
- Clallam Conservation District
- WSU Extension
- Local Consultants
- Large landowners (i.e. Duck Club)
- Elected officials
- North Olympic Land Trust and other Non-profits
- North Olympic Salmon Coalition
- Clallam County Health
- Lead Entity for Salmon
- Strait Local Integrating Organization (PSP)
- Washington Sea Grant
Initial Steps:

Built Environment Risk

Built Environment Risk = \frac{(Exposure + BEV)}{Adaptive Capacity}
Initial Steps:

Restoration Opportunity

Restoration Opportunity = Ecosystem Sensitivity/Adaptive Capacity
Overall Prioritization

Outreach Opportunity Score = Built Environment Risk + Restoration Opportunity

Where

Built Environment Risk = (Exposure * Built Environment Vulnerability)/ Adaptive Capacity

And

Restoration Opportunity = Ecosystem Sensitivity/Adaptive Capacity

*note bias in here that we need to work out relative to home value...
We’ve also got tools:

**Plan Ahead for Sea Level Rise**

For more information on preparing for sea level rise in your area:

- Attend a local Jamestown workshop
- Talk to a developer knowledgeable about installing well shoreline
- Talk to Clallam County Planning:
  166-417-5420
- Call or email the local Shoreline Advice Hotline:
  166-417-5420

**Your Guide to Sea Level Rise Preparedness in the Sequim Bay Region**

Your community is vulnerable to sea level rise because of the low elevation of shoreline homes and properties.

Sea level rise may flood your home unexpectedly when there is a storm surge.

---

**Jamestown S’Klallam Tribe**

**Climate Adaptation Plan 2013**

**Key Area of Concern**

**Jamestown Beach Water Supply**

**VULNERABILITY**

- Low
- Med
- High
- Very High

**IMPORTANCE**

- Water Availability

**POTENTIAL IMPACTS**

- Flooding
- Salt Water Intrusion
- Health and Wellness

**ACTIONS**

- Natural Well
- Second Water Source
- Study Groundwater
- Monitoring & Testing

**WHY THE JAMESTOWN BEACH WATER SUPPLY IS IMPORTANT**

The homes located along Jamestown Beach Road, as well as many of the homes inland, receive their water from a nearby artesian well that was constructed in the 1960s.
Missing Pieces

The “right” event or evidence
Thank you!
Addressing coastal hazards through the NC Coastal Zone Management Program

June 5, 2019
North Carolina’s Coast

320 miles of ocean beaches
10,000+ miles of estuarine shoreline
2.3 million acres of sounds, creeks, and marshes

Coastal tourism generates ~ $3B in annual revenue and supports ~35,000 jobs

Commercial and recreational fishing contribute ~$2B

Significant National Seashores, Wildlife Refuges, and other Federal, State, and local protected areas
NC Coastal Area Management Act (1974)

- Balances competing coastal pressures through development permitting and creation of a Coastal Resources Commission
- Addresses coastal growth and related issues through local/state partnership
- Conserves undeveloped land for education and research through a Coastal Reserve Program
- Enhances public access to beaches and coastal waters through grants to local governments
Division of Coastal Management - Sections

Regulatory Program
- 4 District Offices; Local Permitting Officers

Policy and Planning
- Policy development
- CAMA Land Use Planning
- Waterfront Access Grants
- Clean Marina Program

Coastal Reserve Program
- 10 Coastal Reserves
- Focus on research and education
NC Coastal Resources Commission

• Since 1974, establishes policies and rules under the CAMA and the NC Dredge & Fill Act

• 13 members appointed by the Governor, Senate, House

• Membership includes local gov’t, fishing, science, agriculture, coastal land development experience

• Designates “Areas of Environmental Concern” and related rules & policies
NC CRC Science Panel on Coastal Hazards

• 10 coastal geologists & engineers

Scientific input for CRC policy development:
  – Calculating long-term beach erosion rates
  – Establishing sediment criteria for beach nourishment
  – Delineating Inlet Hazard Areas
  – Monitoring and analysis of groin effects
  – Synthesizing information on sea level rise
    – RSLR projections by region, from ~2 to ~8 inches in next 30 years
Coastal Storms

- Hurricanes of the 1990’s
  - Bertha, Fran, Bonnie, Dennis, Floyd
- Hurricane Floyd (1999)
  - Heavy rains, 10 ft. storm surge; ~$8B
- Hurricane Isabel (2003)
  - 2000’ wide inlet on Hatteras Island
- Hurricane Matthew (2016)
  - ~12 inches of rain, $4.8B damages
- Hurricane Florence (2018)
  - 20-34 inches of rain, up to 13 ft surge
  - $17B disaster
Oceanfront Shorelines

- DCM jurisdiction includes:
  - *Ocean Erodible Areas*
  - *Inlet Hazard Areas*
- Erosion rate-based setbacks based on size of structures
- Ban on permanent erosion control structures
- Rules governing beach and inlet projects
Graduated Construction Setbacks

- Graduated, erosion-based setbacks based on size of structures and local long-term erosion rates
  - Minimum setback = 60 ft
  - < 5000 sf… x30
  - 5-10K sf… x60
  - 10-20K sf.. x65
  - 20-40K sf.. x70
  - 40-60K sf.. x75
  - 60-80K sf.. x80
  - 80-100Ksf.. x85
  - Over 100K.. x90
Estuarine Shorelines

- Estuarine Shoreline Area of Environmental Concern
  - 30 ft shoreline buffer for non-water dependent structures
  - Limitation on impervious surfaces within 75 ft

- DCM focused on promoting “Living Shorelines”
  - Streamlined permitting and demonstration projects
  - Funding, technical assistance and outreach
Coastal Resilience Initiatives

• Governor Cooper’s Executive Order 80
  • Requires state climate risk assessment and resiliency plan
  • Directs agencies to support local resilience planning

• Offering Local Resilience Planning Grants
  • Over past 2 years, funded ~15 projects up to $25K

• Providing Technical Assistance
  • Partnering w/ NC TNC and NC Sea Grant to support community planning efforts
Questions?

Division of Coastal Management

Beach Erosion Study Report
As directed by the NC General Assembly, DCM has completed a study of beach erosion in North Carolina.

www.nccoastalmanagement.net & join CAMAgram!
Addressing coastal hazards along the California coast through planning and permitting

WA’s Coastal Hazards Resilience Network meeting
June 5, 2019

Mary Matella, PhD, Environmental Scientist
California Coastal Commission
Today

Coastal Hazards
Flooding, Erosion & Sea level rise

Hazard Response
Regulatory Background Policy tools

Examples
Innovative Permits LCP Lessons Learned
Pasture flooding near Liscom Pasture, Arcata
Coastal Hazards

Public coastal accessway in Bolinas, CA
Coastal Hazards

Wastewater outflow at Ocean Beach, San Francisco
Coastal Hazards

Bluff erosion at Lands End in Pacifica
Coastal Hazards

Bluff erosion at Lands End in Pacifica
Coastal Hazards

Highway 1 at Surfer’s Beach, Half Moon Bay
Coastal Hazards

Bluff erosion in Isla Vista

Phyllis Griffman
Coastal Hazards

Flooding at Ledbetter Beach, Santa Barbara
Coastal Hazards

Sunset Beach, CA
Coastal Hazards

Imperial Beach

California King Tides Initiative, Jan 2019
Addressing Coastal Hazards

Framework of Coastal Act Policies

Special Communities
Habitat
Wetlands
Wildlife
Public Access
Scenic Views
Agriculture
Priority Land Uses
Principles for Addressing SLR
- Use Best Available Science
- Analyze Planning Scenarios/Development Constraints
- Identify Adaptation Measures
- Design Projects to address hazards and protect coastal resources
- Update LCPs

Additional Coastal Adaptation Guidance
- Residential
- Critical Infrastructure
Coastal Act Implementation: State & Local Partnership

- Coastal Development Permits (CDPs)
- Local Coastal Programs (LCPs)
  - Land Use Plan & Zoning Ordinance
  - Specify kinds, locations, and intensities of development

Santa Monica Beach
Photo Credit: Coastal Commission staff

California Coastal Trail, San Francisco
Photo Credit: Coastal Commission staff
Addressing Coastal Hazards & SLR

Phasing approaches, using CDPs and LCPs

Protect  Accommodate  Retreat

Natural solutions
Addressing Coastal Hazards & SLR

Policy Tools

- Setbacks/project design that incorporate SLR
- Hazard zoning overlays
- Restrictions on future armoring
- Deed restrictions/real estate disclosures
- Triggers for additional requirements in the future
- Committing to additional planning work
Cardiff Beach
Cardiff State Beach Living Shoreline

Pre-project

Post project

Photo: Moffatt & Nichol dune simulation
Piedras Blancas
Caltrans Hwy 1 Realignment

Piedras Blancas

Piedras Blancas Realignment
San Luis Obispo Co.
Ocean Beach
Erosion at Ocean Beach, SF

Coastal Development Permits

Temporary permit and conditions to allow short term protection while a long term plan is identified and implemented.
Erosion at Ocean Beach, SF

Ocean Beach Master Plan
- Stakeholder driven process
- Remove lanes from Great Hwy., and eventually re-route
- Add bike, pedestrian trails
- Dune restoration
- Buried wall to protect wastewater infrastructure

✓ Local Coastal Program Amendment
- Policy development to implement Ocean Beach Master Plan
Lessons Learned

• Context/Scale matters
  – Need willing landowners and partners
• Long timeframes necessary for larger project extents
• Acknowledge risk related to public trust resources
• Incentives for local governments to update policies
Lessons Learned

- Detail informs actionable policies
- Explain assumptions and limitations
- Separate adaptation stage
- Buy-in from stakeholders
- Outreach
- Education
- Start now
- Plan for updates
- Adaptive policies w triggers
Next Steps

Outreach
Guidance & Briefings

Funding
Local Assistance Grant Program

Model Language
Residential & Critical Infrastructure Adaptation

Coordination
Interagency projects
Thank you

Photo Credit: Lauren Garske-Garcia

https://www.coastal.ca.gov/climate/slr/
mary.matella@coastal.ca.gov

Scott’s Creek
Santa Cruz County
HAWAII COASTAL ZONE MANAGEMENT PROGRAM:

ADDRESSING COASTAL HAZARDS

Washington Coastal Hazards Resilience Network
2019 Annual Meeting

June 5, 2019
OVERVIEW OF THE COASTAL ZONE MANAGEMENT PROGRAM
Coastal Zone Management Area

§205A-1 Definitions.
"Coastal zone management area" means all lands of the State and the area extending seaward from the shoreline to the limit of the State’s police power and management authority, including the United States territorial sea;
"Lead agency" means the office of planning;
Coastal Erosion and Hazards

Source: Google Earth

Source: HDOT
Coastal Erosion and Hazards

Source: M. Lander

Source: S. Ma
Coastal Erosion and Hazards

Source: Google Earth

Source: Farmer Ray
CZM Supported Projects

- Assessing the Feasibility and Implications of Managed Retreat Strategies for Vulnerable Coastal Areas in Hawai‘i
- Updating the Hawaii Historical Shoreline Database
- Development of Probabilistic Tsunami Design Zone Mapping
- Building Code Amendments for Coastal Hazards and Climate Change - Oahu
Hawai`i Sea Level Rise Viewer

VISIT:
https://climate.hawaii.gov/commission/
http://www.pacioos.hawaii.edu/shoreline/slr-hawaii/

Source: State of Hawaii and PacIOOS
Ocean Resources Management Plan

§205A-3 Lead agency.
The lead agency shall:

(11) Coordinate the implementation of the ocean resources management plan. [L 1977, c 188, pt of §3; am L 1979, c 200, §2; am L 1989, c 356, §5; am L 1993, c 258, §2; am L 1995, c 104, §6; am L 2001, c 169, §4]

• Focus on integrated management and collaboration
In order to ‘resolve coastal problems and issues’, the ORMP:

• Facilitates enhanced understanding of each other’s responsibilities and challenges, finding management gaps and **opportunities for action**
• **Tracks partner progress** in implementing individual mandates through data collection
• **Encourages partnership** on Action Team projects and implementing actions identified as management gaps
Mahalo!

http://planning.hawaii.gov/czm

State of Hawaii Office of Planning
P.O. Box 2359, Honolulu, Hawaii 96804
(808) 587-2846
Revamping a resource: the CHRN website

Jackson Blalock, Washington Sea Grant
Felicia Olmeta-Schult, Department of Ecology
Karen Morrill-Mcclure, Washington Sea Grant
• Project context and motivations
• Website walk-thru
• Next steps: how CHRN (you!!!) can help
Strengthening the resilience of Washington’s coastal communities to natural hazards impacts through collaboration, education, and resource exchange.

PROJECTED SEA LEVEL RISE FOR WASHINGTON STATE - A 2018 ASSESSMENT

BLOG: MEMBER UPDATES

New material available: Community Update Meeting & Open House Willapa Shoreline Erosion Protection Demonstration Project

Bolstering resilience to weather hazards for the state’s coastal communities.

The Washington Coastal Resilience Project
Goal: Increase regional capacity to build resilience to changes in relative sea level.

Objective: Produce sea level rise projections, guidance, & tools that are usable by coastal communities.
‘The Time To Act Is Now,’ Says Yellowing Climate Change Report Sitting In University Archive

4/01/16 12:15pm • SEE MORE: SCIENCE & TECHNOLOGY •
Audiences

- Technical experts, agencies (CHRN members)
- Local jurisdictions’ staff, commissioners
- Community members engaged in planning and development
Where should we go to assess SLR-related community needs?

MRC representation:
Government:
  Tribal
  Federal
  State
  Counties
  Cities
Parks & preserves
Conservation/Environment
Tribal interest
Local citizens
Education
Science
Recreation
Sport fishing
Commercial fishing
Aquaculture
Ports
Economic groups
Materials development

Co-production
20+ economic orgs.

Outreach events
King Tides Viewing Parties, SCPG trainings
Takeaways

Lack of ability to apply info in context
- “gradient of complexity”: multiple audiences
- “5-15-45 minute” approach
- Project-based application

Communicate basics – simplify approaches
- “How much, when, what can I do about it?”
- Relate to existing activity and events
- Focus on visuals: graphics, photos and maps
Where should these (and more) products live?
Strengthening the resilience of Washington’s coastal communities to natural hazards impacts through collaboration, education, and resource exchange.
Updates

• Mission: “Orientation”
• Content: “gradient of complexity” to meet multiple audiences, targets usability
• Hazard-specific introduction pages
**Updates**

- Mission: “Orientation”
- Content: “gradient of complexity” to meet multiple audiences, targets usability
- Hazard-specific introduction pages
- Hazard-specific research pages (data, tools, etc.)
Updates

• Mission: “Orientation”
• Content: “gradient of complexity” to meet multiple audiences, targets usability
• Hazard-specific introduction pages
• Hazard-specific research pages (data, tools, etc.)
• Examples and resources for project development
Updates

• Mission: “Orientation”
• Content: “gradient of complexity” to meet multiple audiences, targets usability
• Hazard-specific introduction pages
• Hazard-specific research pages (data, tools, etc.)
• Examples and resources for project development
• Network activity
WASHINGTON COASTAL HAZARDS RESILIENCE NETWORK

Strengthening the resilience of Washington's coastal communities through collaboration, education, and knowledge exchange.

Orienting you to relevant science, best practices, and other resources related to coastal hazards.
What’s on the horizon?
Get involved!

• Review website before release
• Share useful coastal hazards tools and research
• Write a blog post: wacoastalnetwork@gmail.com
• Share case studies of adaptation efforts
• SHARE and USE the website in your work
Stay in touch!

with everyone in this room...
with WAcoastalnetwork.com...

jackbla@uw.edu
Adaptation Case Studies

PRESENTED BY
Katrina Radach\textsuperscript{1,2}, Jackson Blalock\textsuperscript{1,2}, Alex Rosen\textsuperscript{3}

\textsuperscript{1} The Nature Conservancy, \textsuperscript{2} Washington Sea Grant, \textsuperscript{3} Department of Ecology
What are the Adaptation Case Studies?
Project Background

• **Department of Ecology:**
  - Communities were asking for examples
  - Difficult to follow up with communities
  - Discovered case studies would be a valuable tool
  - Strong need for capturing relevant risk reduction examples

• **TNC with WCRP**
  - Lack of alternative measures
  - Knowledge gaps
  - Access to information
  - Locally applicable solutions
  - Staffing challenges

• **Merging efforts between Ecology, WCRP, and TNC**
Surveys – Still Active!

- 26 responses, so far…
- Erosion = primary hazard being mitigated
- Structural mitigation strategies most common
- Damage or threat of damage is greatest motivation for these efforts
- Diverse array of opportunities to enhance outcomes, most prominently:
  - Access to data
  - Engineering guidance
  - Enhanced cross-agency collaboration
Case Study Interviews

- Regulatory Requirements
- Cost / Funding Dynamics
- Partnerships
- Challenges / Barriers
- Lessons Learned
- Identification of local “champions”
- Top Recommendations
Lessons Learned

• Work with agencies at the beginning. Conversations around collaboration

• Design with Nature

• Hire experienced consultants/engineers

• Budget and plan ahead

• And More!
Coastal Hazards Adaptation Examples

Interested in submitting a new project example? Take our Coastal Hazards Mitigation and Risk Reduction Project Survey

Case Studies Atlas

The Washington Coastal Resilience Project
Who is it for?
The Who

• Homeowners & Non-Technical Audiences
• Local Governance
• Tribes
• Conservation Districts
• Planners
• Consultants
• Marine Resource Committees
• Anyone who works or is interested in Coastal Hazards
Where can we find it?
Strengthening the resilience of Washington's coastal communities through collaboration, education, and resource exchange.

Orienting you to relevant science, best practices, and resources related to coastal hazards.

Coastal Hazards

Hazards Research

Local Adaptation Examples

The Washington Coastal Resilience Project

http://www.wacoastalnetwork.com
Questions?

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<td>Bulkhead regs; soft shore alternatives</td>
<td>SLR + bulkhead impacts</td>
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<td>Sydney Fishman</td>
<td>SLR + Capital grant programs; CHAN website - membership + blog</td>
<td>SLR in grants &amp; projects</td>
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<td>Kathryn Radach</td>
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<td>Becky Lunde</td>
<td>...and new NOAA tools</td>
<td>Community adaptation efforts, Adaptation planning &amp; policy</td>
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<td>Kira Nelson</td>
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<td>Brian McIntegue</td>
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